

CANADIAN PAEDIATRIC SURVEILLANCE PROGRAM

Study explores connection between hyponatremia and intravenous fluids

Each year, it is estimated that 200 patients under the age of 18 acquire acute symptomatic hyponatremia after receiving intravenous (IV) fluids in the hospital or during transfer. It's a small—but significant—number of the 280,000 paediatric patients discharged from Canadian hospitals each year.

Significant says Dr. Carolyn Beck of Toronto's Sick Kids Hospital, because of the potential for illness and because it is often preventable.

"These are children who don't necessarily have reason for electrolyte abnormalities," she said. "It's a routine practice in terms of receiving IV fluids. And if we're putting kids at risk for hyponatremia and the consequences that can happen, then that's a preventable issue and we should be doing our best to prevent morbidity and mortality."

Dr. Beck is principal investigator of a current study under the Canadian Paediatric Surveillance Program (CPSP) about hospitalized children who acquire acute symptomatic hyponatremia after receiving IV fluids that is not otherwise explained by a pre-existing medical condition.

Hyponatremia occurs when blood sodium level drops too low, too fast, causing the brain to swell. Consequences range from mild and non-specific, such as nausea and headache, to severe and may include seizures, respiratory arrest, neurologic dysfunction or even death. Typically, consequences are more serious for children than for adults.

Dr. Beck wonders if these cases are related to the amount of sodium traditionally found in IV fluids. A 1957 study examined the sodium and electrolyte requirements of healthy children and has since been used to

Symptomatic acute hyponatremia is defined as:

1) A fall in serum sodium from the normal range (135–145 mmol/L) to <130 mmol/L within 48 hours. (In the case of a previously healthy child hospitalized for elective reasons, in whom baseline laboratory values were not drawn, a serum sodium <130 mmol/L, within 48 hours of IV fluid initiation, will be accepted.)

AND

2) Temporally accompanied by one or more of the following manifestation(s):

- Seizures
- Decreased level of consciousness
- Loss of consciousness
- Respiratory arrest
- Cardiac arrest
- Death

gauge the appropriate amount of sodium typically found in IV fluids.

But there is a big difference between sodium requirements of sick children and healthy children, not to mention changes to medicine, patient lifestyle and hospital procedures since 1957, all of which affect patient health and well-being.

"We now have evidence to believe [sick kids] are at higher risk for developing low sodium, or hyponatremia," said Dr. Beck. "And should that develop quickly, to a significant enough degree they get into trouble with brain swelling, that's where you get the neurologic symptoms."

The secretion of anti-diuretic hormone (ADH), released when a person experiences stress, nausea, respiratory illness or a viral or bacterial infection, may further put a patient at risk. ADH causes water retention, which further dilutes the concentration of sodium in the body.

"Risk factors for ADH secretion include things that are fairly non-specific, so you'd be hard pressed to find a hospitalized kid who doesn't have at least one risk factor," said Dr. Beck.

The link between acute hyponatremia and IV fluids is typically studied through randomized clinical trials, which use small sample sizes and usually aren't able to differentiate between mild and severe hyponatremia. The result is a lack of data about the actual number of adverse cases every year.

"The [adverse] outcomes I mentioned are clinically significant but are very rare. Researchers are very unlikely to capture those outcomes with smaller trials. That's why I thought that surveillance at a national level might capture some of these rare outcomes that are less easily studied," said Dr. Beck.

With over 2,500 participants across the country—including 37 general and subspecialty surgeons for the purpose of this study—the CPSP offers a unique opportunity to study the number and severity of adverse cases in Canada.

Dr. Beck is hoping that results of the study will also help to establish a revised standard for IV fluid guidelines.

"Traditionally, very hypotonic solutions have been used. Because of reports in some literature which suggest that this is happening, there's been a move towards using what we call isotonic fluid. What exactly we should be doing? The jury's out."

This study runs from March 2012 to February 2014. To read the protocol, go to www.cps.ca → Surveillance → Canadian Paediatric Surveillance Program → Studies